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JAN 04 2007

The following remarks are responsive to the Office Action mailed October 4, 2006.

Applicants respectfully request reconsideration of the present application.

*Office Action Summary*

Claims 1-20 and 38-43 have been rejected under 35 USC §101 as being directed to non-statutory subject matter. Claims 21-37 and 44-49 have been allowed.

*Status of Claims*

At the time the Office Action was mailed, claims 1-49 were pending in the application. In the present response, claims 1 and 38 have been amended. No claims have been added or canceled. Therefore, claims 1-49 remain pending in the present application. Given that claims 21-37 and 44-49 have been allowed, the following comments are directed only to the rejected claims.

*Claim Rejections Under 35 U.S.C. §101*

Claims 1-20 and 38-43 have been rejected under 35 USC §101 as being directed to non-statutory subject matter.

*Claim 1*

As amended, claim 1 recites:

A method of registering a 2D (two-dimensional) x-ray image of a target with previously generated 3D (three-dimensional) scan data of said target, said x-ray image being characterized by an image plane defined by mutually orthogonal x- and y- coordinates, the method comprising:

- A. generating at least one reconstructed image from said 3D scan data, said reconstructed image also characterized by the same image plane;

B. determining the value of in-plane transformation parameters ( $x, y, \theta$ ) and out-of-plane rotational parameters ( $r, \phi$ ) for registering said reconstructed image onto said x-ray image, said in-plane and out-of-plane parameters representing a difference in the position of the target as shown in said x-ray image as compared to the position of the target as shown by said image reconstructed from said 3D scan data;

wherein  $r$  and  $\phi$  represent rotations of said target about first and second mutually orthogonal axes, said rotations being out-of-plane with respect to said image plane, said out-of-plane rotations representing a projection of said target onto said image plane;

wherein  $x$  and  $y$  represent an amount of translation of said target within said image plane in the directions of said  $x$ - and  $y$ - axes, respectively, and  $\theta$  represents an amount of rotation of said target within said image plane about an axis perpendicular to both said  $x$ - and said  $y$ - axes;

and wherein step B comprises:

- a. obtaining an initial estimate for said in-plane transformation parameters ( $x, y, \theta$ ) by multi-level matching in 3D (three dimensions), between said x-ray image and said reconstructed image;
  - b. based on said in-plane transformation parameters ( $x, y, \theta$ ) estimated in step a, performing an initial search in one dimension (1D) for each pair of out-of-plane rotation parameters ( $r, \phi$ ); and
  - c. iteratively refining said in-plane transformation parameters ( $x, y, \theta$ ) and said out-of-plane rotational parameters ( $r, \phi$ ), until said in-plane and out-of-plane parameters converge to a desired accuracy; and
- C. aligning a radiation source to the target using the values of the in-plane transformation parameters and the out-of-plane rotational parameters.

(emphasis added).

Applicants respectfully submit that claim 1, as amended, recites statutory subject matter under 35 USC §101 at least because **aligning a radiation source to the target using the values of the in-plane transformation parameters and the out-of-plane rotational parameters** is a useful, concrete and tangible result as discussed in MPEP 2106.

#### Claims 2-20

Given that claims 2-20 depend from claim 1, either directly or indirectly, and include all

of the limitations of claim 1, applicants respectfully submit that claims 2-20 also recite statutory subject matter under 35 USC §101.

**Claim 38**

As amended, claim 38 recites:

A method, comprising:

acquiring x-ray images of a target volume in a first image plane and a second image plane, the x-ray images defining a present orientation of the target volume;

generating synthetic x-ray reference images of the target volume from 3-dimensional scan data representing a previous orientation of the target volume, the synthetic x-ray reference images corresponding to in-plane transformations and out-of-plane rotations of the target volume projected onto the first image plane and the second image plane;

determining a difference between the present orientation of the target volume and the previous orientation of the target volume in three translational coordinates and three rotational coordinates by comparing in-plane transformation parameters and out-of-plane rotation parameters of the x-ray images and the synthetic x-ray reference images in the first image plane and the second image plane, wherein determining said difference comprises searching the in-plane transformation parameters in the first image plane and the second image plane using a first similarity measure between the x-ray images and the synthetic x-ray reference images in a 3-dimensional multi-level search; and

**aligning a radiation source to the target volume using the difference between the present orientation of the target volume and the previous orientation of the target volume.**

(emphasis added).

Applicants respectfully submit that claim 38, as amended, recites statutory subject matter under 35 USC §101 at least because **aligning a radiation source to the target volume using the difference between the present orientation of the target volume and the previous orientation of the target volume** is a useful, concrete and tangible result as discussed in MPEP 2106.

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*Claims 39-43*

Given that claims 39-43 depend from claim 38, either directly or indirectly, and include all of the limitations of claim 38, applicants respectfully submit that claims 39-43 also recite statutory subject matter under 35 USC §101.

*Conclusion*

In view of the arguments and amendments set forth herein, applicants respectfully submit that all objections and rejections have been overcome, and that the present application is in condition for allowance. Applicants respectfully request that a timely Notice of Allowance be issued in this case.


If the Examiner believes a telephone interview would expedite the prosecution of this application, the Examiner is invited to contact Richard Thill at (408) 720-8300 x 238.

If there are any additional charges, please charge our Deposit Account No. 02-2666.

Respectfully submitted,

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